

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

Claim 1 (currently amended): A process of operating a vertical glass bead furnace, the furnace including a shaft open at the bottom, a raw material addition device, and an air-fuel burner, comprising the steps of:

- firing the air-fuel burner and thereby entraining air into the furnace shaft through the open bottom of the shaft;
- adding raw material into the furnace; and
- an at least one additional step selected from the group consisting of
  - (a) ~~injecting oxidant into the shaft adjacent to the shaft bottom~~  
upstream of the air-fuel burner using a single lance;
  - (b) ~~operating an oxy-fuel burner in the shaft adjacent to the shaft bottom~~  
upstream of the air-fuel burner;
  - (c) ~~injecting oxidant into the shaft adjacent to the shaft bottom~~  
upstream of the air-fuel burner using multiple lances;
  - (d) injecting oxidant into the shaft using a lance incorporated into the center of the air-fuel burner; and
  - (e) ~~injecting oxidant into the shaft adjacent to the shaft bottom~~  
upstream of the air-fuel burner using an oxidant injection ring.

Claim 2 (original): A process in accordance with Claim 1, wherein the additional step comprises injecting oxidant into the shaft adjacent to the shaft bottom using a single lance.

Claim 3 (original): A process in accordance with Claim 2, wherein the step of injecting oxidant using a single lance comprises injecting oxidant upward along the center of the furnace.

Claim 4 (original): A process in accordance with Claim 2, wherein the step of firing an air-fuel burner comprises firing with an equivalence ratio  $E$ ,  $0.7 \leq E \leq 1.0$

Claim 5 (original): A process in accordance with Claim 2, wherein the step of injecting oxidant using a single lance comprises injecting oxidant at a velocity between about 500 ft/s and about 800 ft/s.

Claim 6 (original): A process in accordance with Claim 1, wherein the additional step comprises operating an oxy-fuel burner in the shaft adjacent to the shaft bottom.

Claim 7 (original): A process in accordance with Claim 6, wherein the step of operating an oxy-fuel burner adjacent to the shaft bottom comprises operating an oxy-fuel burner with a flame stoichiometry  $R$ , with  $0.5 \leq R \leq 2.0$ .

Claim 8 (original): A process in accordance with Claim 6, wherein the step of operating an oxy-fuel burner adjacent to the shaft bottom comprises operating an oxy-fuel burner directed upward along the center of the furnace.

Claim 9 (original): A process in accordance with Claim 1, wherein the additional step comprises injecting oxidant into the shaft adjacent to the shaft bottom using multiple lances.

Claim 10 (original): A process in accordance with Claim 9, wherein the step of injecting oxidant into the shaft adjacent to the shaft bottom using multiple lances comprises injecting oxidant at a velocity between about 1 ft/s and about 100 ft/s.

Claim 11 (original): A process in accordance with Claim 9, wherein the step of injecting oxidant using multiple lances comprises injecting at an angle relative to the vertical axis of the furnace, with  $0^\circ \leq \alpha \leq 80^\circ$ .

Claim 12 (original): A process in accordance with Claim 1, wherein the additional step comprises injecting oxidant into the shaft using a lance incorporated into the air-fuel burner.

Claim 13 (original): A process in accordance with Claim 12, wherein the step of injecting oxidant into the shaft using a lance incorporated into the air-fuel burner comprises injecting oxidant at a velocity between about 30 ft/s and about 100 ft/s.

Claim 14 (original): A process in accordance with Claim 1, wherein the additional step comprises injecting oxidant into the shaft adjacent to the shaft bottom using an oxidant injection ring.

Claim 15 (original): A process in accordance with Claim 14, wherein the step of injecting oxidant into the shaft adjacent to the shaft bottom using an oxidant injection ring comprises injecting oxidant at a velocity between about 30 ft/s and about 200 ft/s.

Claim 16 (original): A process in accordance with Claim 14, wherein the furnace has an internal diameter  $D_F$ , and wherein the step of injecting using an injection ring comprises injecting using an injection ring having an external diameter  $D_R$ , and wherein  $0.2 \leq D_R / D_F \leq 0.9$ .

Claim 17 (currently amended): A vertical glass furnace comprising:  
a shaft having an interior space and open at the bottom;  
a raw material addition device mounted so to add raw material to the interior of the shaft;  
an air-fuel burner; and  
an additional device selected from the group consisting of:

- (a) a single oxidant injection lance ~~adjacent to the shaft bottom~~upstream of the air-fuel burner useful for injecting oxidant into the shaft;
- (b) an oxy-fuel burner in the shaft ~~adjacent to the shaft bottom~~upstream of the air-fuel burner;
- (c) multiple oxidant injection lances ~~adjacent to the shaft bottom~~upstream of the air-fuel burner useful for injecting oxidant into the shaft;
- (d) a lance incorporated into the center of the air-fuel burner; and
- (e) an oxidant injection ring positioned for injecting oxidant into the shaft ~~adjacent to the shaft bottom~~upstream of the air-fuel burner.

Claim 18 (original): A vertical glass furnace in accordance with Claim 17, wherein the device comprises a single oxidant injection lance adjacent to the shaft bottom useful for injecting oxidant into the shaft.

Claim 19 (original): A vertical glass furnace in accordance with Claim 18, wherein the furnace has a center, and wherein the single lance is directed upward along the center of the furnace.

Claim 20 (original): A vertical glass furnace in accordance with Claim 17, wherein the device comprises an oxy-fuel burner in the shaft adjacent to the shaft bottom.

Claim 21 (original): A vertical glass furnace in accordance with Claim 20, wherein the furnace comprises a center, and wherein the oxy-fuel burner is directed upward along the center of the furnace.

Claim 22 (original): A vertical glass furnace in accordance with Claim 17, wherein the device comprises multiple oxidant injection lances adjacent to the shaft bottom useful for injecting oxidant into the shaft.

Claim 23 (original): A vertical glass furnace in accordance with Claim 22, wherein the furnace has a vertical axis, and wherein the multiple lances are each oriented to inject at an angle  $\alpha$  relative to the vertical axis of the furnace, with  $0^\circ \leq \alpha \leq 80^\circ$ .

Claim 24 (original): A vertical glass furnace in accordance with Claim 17, wherein the device comprises a lance incorporated into the air-fuel burner.

Claim 25 (original): A vertical glass furnace in accordance with Claim 17, wherein the device comprises an oxidant injection ring positioned for injecting oxidant into the shaft adjacent to the shaft bottom.

Claim 26 (original): A vertical glass furnace in accordance with Claim 25, wherein the furnace has an internal diameter  $D_F$ , wherein the injection ring has an external diameter  $D_R$ , and wherein  $0.2 \leq D_R / D_F \leq 0.9$ .